What is claimed is:

1. A method of manufacturing an interconnect comprising:

a) depositing and patterning a first conductive layer;

b) depositing a first insulative layer over the first patterned conductive layer;

c) opening an air gap in the first insulative layer; and

d) depositing a sealing layer over the first insulative layer and the air gap to seal the air gap.

2. The method of Claim 1 wherein the step of opening an air gap in the first insulative layer includes the steps of:

a) applying a photoresist material to the first insulative layer, said photoresist material defining an air gap pattern; and

b) etching the air gap in the first insulative layer based on the air gap pattern.

3. The method of Claim 1 further comprising

opening a via hole in the sealing layer and first insulative layer.

4. The method of Claim 3 wherein the step of opening a via hole in the sealing layer and the first insulative layer includes the steps of:

a) applying a photoresist material to the sealing layer, said photoresist material defining a via hole pattern; and

b) etching a via hole in the sealing layer and first insulative layer based on the via hole pattern.

5. The method of Claim 3 further comprising the steps of:

forming a conductive plug in the via hole;

depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

6. The method of Claim 3 further comprising the steps of:

simultaneously forming a conductive plug in the via hole and depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

7. The method of Claim 1 further comprising the steps of:

depositing a second insulative layer over the sealing layer; and

forming a via hole through the second insulative layer, the sealing layer, and the first insulative layer.

8. The method of Claim 7 further comprising the steps of:

forming a conductive plug in the via hole;

depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

9. The method of Claim 7 further comprising the steps of:

simultaneously forming a conductive plug in the via hole and depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

10. The method of Claim 1 further comprising the steps of:

depositing a second insulative layer over the sealing layer;

depositing a hard mask over the second insulative layer; and

forming a via hole through the hard mask, the second insulative layer, the sealing layer, and the first insulative layer.

11. The method of Claim 10 further comprising the steps of:

forming a conductive plug in the via hole;

depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

12. The method of Claim 10 further comprising the steps of:

simultaneously forming a conductive plug in the via hole and depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

13. A method of manufacturing an interconnect comprising:

a) depositing and patterning a first conductive layer;

b) depositing a first insulative layer over the first patterned conductive layer;

c) depositing a first hard mask on the first insulative layer;

d) opening an air gap in the first hard mask and the first insulative layer; and

e) depositing a sealing layer over the first hard mask and the air gap to seal the air gap.

14. The method of Claim 13 wherein the step of opening an air gap in the first hard mask and the first insulative layer includes the steps of:

a) applying a photoresist material to the first hard mask, said photoresist material defining an air gap pattern; and

b) etching the air gap in the first hard mask and the first insulative layer based on the air gap pattern.

15. The method of Claim 13 further comprising

opening a via hole in the sealing layer, the first hard mask, and first insulative layer.

16. The method of Claim 15 wherein the step of opening a via hole in the sealing layer, the first hard mask, and the first insulative layer includes the steps of:

a) applying a photoresist material to the sealing layer, said photoresist material defining a via hole pattern; and

b) etching a via hole in the sealing layer, the first hard mask, and first insulative layer based on the via hole pattern.

17. The method of Claim 15 further comprising the steps of:

forming a conductive plug in the via hole;

depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

18. The method of Claim 15 further comprising the steps of:

simultaneously forming a conductive plug in the via hole and depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

19. The method of Claim 13 further comprising the steps of:

depositing a second insulative layer over the sealing layer; and

forming a via hole through the second insulative layer, the sealing layer, the first hard mask, and the first insulative layer.

20. The method of Claim 19 further comprising the steps of:

forming a conductive plug in the via hole;

depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

21. The method of Claim 19 further comprising the steps of:

simultaneously forming a conductive plug in the via hole and depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

22. The method of Claim 13 further comprising the steps of:

depositing a second insulative layer over the sealing layer;

depositing a second hard mask over the second insulative layer; and

forming a via hole through the second hard mask, the second insulative layer, the sealing layer, the first hard mask, and the first insulative layer.

23. The method of Claim 22 further comprising the steps of:

forming a conductive plug in the via hole;

depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

24. The method of Claim 22 further comprising the steps of:

simultaneously forming a conductive plug in the via hole and depositing a second conductive layer over the sealing layer; and

patterning the second conductive layer.

25. An interconnect structure comprising:

a) a first layer of patterned conductive material having a first interconnect line, a second interconnect line and a trench therebetween;

b) a first insulating material held within the trench and disposed over the first layer of patterned conductive material;

c) at least two air gaps within the first insulating material and between the first interconnect line and the second interconnect line, said air gaps separated by a support pillar; and

d) a sealing layer over the first insulating material for sealing the air gaps.

26. The interconnect structure of Claim 25 wherein the sealing layer is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers), fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

27. The interconnect structure of Claim 25 wherein the first insulating material is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers),

fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

28. The interconnect structure of Claim 25 further comprising:

a) a second layer of patterned conductive material over the sealing layer; and

b) a via opening within the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

29. The interconnect structure of Claim 28 wherein the conductive material for the first conductive layer, the second conductive layer, and the conductive plug is selected from the group consisting of polysilicon, titanium, titanium nitride, tantalum, tantalum nitride, tungsten, copper, aluminum, and aluminum alloy.

30. The interconnect structure of Claim 25 further comprising

a) a second insulating material over the sealing layer;

b) a second layer of patterned conductive material over the second insulating material; and

c) a via opening within the second insulating material, the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

31. The interconnect structure of Claim 30 wherein the second insulating material is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers), fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

32. The interconnect structure of Claim 30 wherein the conductive material for the first conductive layer, the second conductive layer, and the conductive plug is selected from the group consisting of polysilicon, titanium, titanium nitride, tantalum, tantalum nitride, tungsten, copper, aluminum, and aluminum alloy.

33. The interconnect structure of Claim 25 further comprising

a) a second insulating material over the sealing layer;

b) a hard mask over the second insulating material;

c) a second layer of patterned conductive material over the hard mask; and

d) a via opening within the hard mask, the second insulating material, the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

34. The interconnect structure of Claim 33 wherein the second insulating material is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers), fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

35. The interconnect structure of Claim 33 wherein the conductive material for the first conductive layer, the second conductive layer, and the conductive plug is selected from the group consisting of polysilicon, titanium, titanium nitride, tantalum, tantalum nitride, tungsten, copper, aluminum, and aluminum alloy.

36. The interconnect structure of Claim 33 wherein the hard mask is comprised of a material selected from the group consisting of silicon nitride, silicon carbide, and silicon oxide.

37. An interconnect structure comprising:

a) a first layer of patterned conductive material having a first interconnect line, a second interconnect line and a trench therebetween;

b) a first insulating material held within the trench and disposed over the first layer of patterned conductive material;

c) a first hard mask over the first insulating material;

d) at least two air gaps within the first insulating material and first hard mask and between the first interconnect line and the second interconnect line, said air gaps separated by a support pillar; and

e) a sealing layer over the first insulating material for sealing the air gaps.

38. The interconnect structure of Claim 37 wherein the sealing layer is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers), fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

39. The interconnect structure of Claim 37 wherein the first insulating material is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers), fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

40. The interconnect structure of Claim 37 further comprising:

a) a second layer of patterned conductive material over the sealing layer; and

b) a via opening within the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

41. The interconnect structure of Claim 40 wherein the conductive material for the first conductive layer, the second conductive layer, and the conductive plug is selected from the group consisting of polysilicon, titanium, titanium nitride, tantalum, tantalum nitride, tungsten, copper, aluminum, and aluminum alloy.

42. The interconnect structure of Claim 37 further comprising

a) a second insulating material over the sealing layer;

b) a second layer of patterned conductive material over the second insulating material; and

c) a via opening within the second insulating material, the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

43. The interconnect structure of Claim 42 wherein the second insulating material is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers), fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

44. The interconnect structure of Claim 42 wherein the conductive material for the first conductive layer, the second conductive layer, and the conductive plug is selected from the group consisting of polysilicon, titanium, titanium nitride, tantalum, tantalum nitride, tungsten, copper, aluminum, and aluminum alloy.

45. The interconnect structure of Claim 37 further comprising

a) a second insulating material over the sealing layer;

b) a second hard mask over the second insulating material;

c) a second layer of patterned conductive material over the second hard mask; and

d) a via opening within the second hard mask, the second insulating material, the sealing layer, the first hard mask, and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

46. The interconnect structure of Claim 45 wherein the second insulating material is selected from the group consisting of silicon oxide (SiO_2), doped SiO_2, spin on glass (SOG), silicon nitride, low dielectric constant (low-k) materials, silsesquioxanes, polyimides, fluorinated-polyimides, parylene, fluoro-polymers, poly(arylethers), fluorinated-poly(arylethers), porous-polymer/polyimide, polytetrafluoroethylene, and porous silica.

47. The interconnect structure of Claim 45 wherein the conductive material for the first conductive layer, the second conductive layer, and the conductive plug is selected from the group consisting of polysilicon, titanium, titanium nitride, tantalum, tantalum nitride, tungsten, copper, aluminum, and aluminum alloy.

48. The interconnect structure of Claim 37 wherein the first hard mask is comprised of a material selected from the group consisting of silicon nitride, silicon carbide, and silicon oxide.

49. The interconnect structure of Claim 45 wherein the material for the first and second hard mask is selected from the group consisting of silicon nitride, silicon carbide, and silicon oxide.

50. The interconnect structure of Claim 25 wherein the air gap has a top sectional having one of the following shapes: circle, oval, square, and rectangle.

51. The interconnect structure of Claim 37 wherein the air gap has a top sectional having one of the following shapes: circle, oval, square, rectangle.

52. An interconnect structure comprising:

a) a first layer of patterned conductive material having trenches, each trench having an X dimension and a Y dimension;

b) a first insulating material held within the trench and disposed over the first layer of patterned conductive material;

c) a first air gap and a second air gap within the first insulating material, said first air gap and said second air gap disposed along the X dimension of the trench and separated by a support pillar,

d) a sealing layer over the first insulating material for sealing the first air gap and second air gap;

e) a second layer of patterned conductive material over the sealing layer; and

f) a via opening within the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

53. An interconnect structure comprising:

a) a first layer of patterned conductive material having trenches, each trench having an X dimension and a Y dimension;

b) a first insulating material held within the trench and disposed over the first layer of patterned conductive material;

c) a first air gap and a second air gap within the first insulating material, said first air gap and said second air gap disposed along the Y dimension of the trench and separated by a support pillar;

d) a sealing layer over the first insulating material for sealing the first air gap and second air gap;

e) a second layer of patterned conductive material over the sealing layer; and

f) a via opening within the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

54. An interconnect structure comprising:

a) a first layer of patterned conductive material having an interconnect line and trenches;

b) a first insulating material held within the trench and disposed over the first layer of patterned conductive material;

c) an air gap within the first insulating material, said air gap directly against the interconnect line;

d) a sealing layer over the first insulating material for sealing the first air gap and second air gap;

e) a second layer of patterned conductive material over the sealing layer; and

f) a via opening within the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

55. The interconnect structure of Claim 54 further comprising

a) a support pillar made from the first insulating material disposed adjacent to the air gap.

56. An interconnect structure comprising:

a) a first layer of patterned conductive material having an interconnect line and trenches, said interconnect line having a top surface;

b) a first insulating material held within the trench and disposed over the first layer of patterned conductive material;

c) an air gap within the first insulating material, said air gap extending from the top surface of the interconnect line;

d) a sealing layer over the first insulating material for sealing the first air gap and second air gap;

e) a second layer of patterned conductive material over the sealing layer; and

f) a via opening within the sealing layer and first insulating material for holding a conductive plug that provides a connection between the first layer of conductive material and the second layer of conductive material.

57. A method of manufacturing an interconnect comprising:

a) providing a first patterned layer of conductive material, the first patterned layer having trenches;

b) depositing a first insulating material over the first patterned layer to fill the trenches of said first patterned layer;

c) etching at least two air gaps in the first insulative material; and

d) depositing a sealing layer over the first insulative layer and the air gap to seal the air gap.

58. The method of manufacturing an interconnect of claim 57 wherein each trench has an X dimension and a Y dimension and wherein said step of etching air gaps in the first insulative material further includes the step of

a) etching a first air gap and a second air gap in the X dimension of the trench filled with the first insulative material; and

b) leaving a support pillar between the first air gap and the second air gap.

59. The method of manufacturing an interconnect of claim 57 wherein each trench has an X dimension and a Y dimension and wherein said step of etching air gaps in the first insulative material further includes the step of

a) etching a first air gap and a second air gap in the Y dimension of the trench filled with the first insulative material; and

b) leaving a support pillar between the first air gap and the second air gap.

60. The method of manufacturing an interconnect of claim 57 wherein the first patterned layer includes an interconnect line, said interconnect line having a top surface and wherein said step of etching air gaps in the first insulative material further includes the step of

a) etching a first air gap on the top that extends to the top surface of the interconnect line.

61. The interconnect structure of Claim 30, wherein the first insulating material and the second insulating material are the same material.

62. The interconnect structure of Claim 30, wherein the first insulating material and the second insulating material are different materials.

63. The interconnect structure of Claim 42, wherein the first insulating material and the second insulating material are the same material.

64. The interconnect structure of Claim 42, wherein the first insulating material and the second insulating material are different materials.

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